

cardiac damage is most severe, and I agree heartily with Doctor Belford that the tonsils should always be removed when the acute phase is passed. It is also most important to investigate the paranasal sinuses and teeth. An innocent-appearing tonsil may contain pus in its depths, and an innocent-appearing nose may shelter an infected antrum.

VARICOSE VEINS—THEIR CHEMICAL OBLITERATION*

By JOHN HOMER WOOLSEY, M. D.

AND

RAYMUND J. MILLZNER, M. D.
San Francisco

DISCUSSION by Thomas O. Burger, M. D., San Diego;
Horace F. Pierce, M. D., Santa Barbara.

THE obliteration of varicose veins by the injection of chemical irritants is by no means a new procedure. It is, however, only now beginning to receive the recognition and popularity it deserves. The credit of popularizing the method belongs to the French workers in the field, especially Sicard and Genevrier.

TESTS PRELIMINARY TO TREATMENT

There are three important tests that should be carried out before treatment is instituted.

1. The first, or Trendelenburg test, is to determine if the valves function and the location of the reflow of blood. This test is performed by elevating the leg, emptying the superficial venous system, placing a tourniquet sufficiently tight to compress the internal saphenous vein in the mid-thigh region, and then lowering the leg to see if the veins remain collapsed. If they do remain collapsed, then the reflow comes directly from the internal saphenous vein at its normal junction with the femoral vein in Scarpa's triangle. If, when the tourniquet is still in place, this vein and its tributaries fill, then the reflow is from some other connection with the deep venous system. Such a direct connection occasionally exists between the internal saphenous vein and the femoral vein a short distance above the knee. Consequently, in case of reflow, the test is reapplied with the tourniquet below the point where the internal saphenous vein and femoral vein may join, that is, just above the knee. If necessary the test is then repeated with the tourniquet just below the knee to determine the possible association of the external saphenous vein with the varicosities.

2. The second, or Homan's test, is to determine if the valves of the connecting veins function. This test is performed by elevating the leg, emptying the superficial venous system, and then applying the tourniquet below the level of the junction of the external saphenous vein and the popliteal vein. The leg is lowered and the time necessary for refill noted. If the varicosities fill within forty-five seconds, it indicates that there is a reflow of blood from the deeper venous set through the connecting veins into the superficial venous set.

3. The third, or Mayo test, is to determine the efficiency of the deeper set of veins. This test is carried out by elevating the leg, bandaging from the foot to just above the knee, and having the patient walk briskly about for ten minutes. The bandage should be elastic and applied sufficiently tight to collapse the varicosities. Deficiency of the deep venous circulation is evidenced by the occurrence of cramps in the leg, with or without "pins and needles" sensations in the toes. In case of doubt as to the result of this test, the patient is asked to wear the bandage for twelve to twenty-four hours.

ADVANTAGES OF THE INJECTION METHOD

The injection method has several decided advantages over surgery. It is simple and practically painless. It does not incapacitate the patient from any of his daily duties. It avoids the scars which after operation may seem more disfiguring and annoying to the patient than the varicosities. As a result, many patients who would refuse operation will consent to the treatment, thus saving themselves the loss of efficiency and the discomfort from their varicosities and avoiding the ever present possibility of future ulceration or phlebitis.

The basic principle of the chemical treatment is to damage the intima of the vein wall and thus produce thrombosis. Various solutions have been advised and are employed.

SOLUTIONS USED

Sodium Salicylate Solution.—Sodium salicylate in 20 per cent solution has given us our best results. We inject 5 cubic centimeters at a time. The obliteration following injection has varied from 2 to 25 centimeters, but averages about 10 centimeters. We have had no sloughs of the subcutaneous tissues and only an occasional small skin slough following leakage of this solution at the site of injection. As a rule there is a brief burning pain, which begins near the end of the injection and lasts from one to two minutes. This is sometimes accompanied by very transient cramps of the local leg muscles. Stronger solutions, such as 30 and 40 per cent, have not given better results and have usually caused very severe burning and cramping.

Quinin Urethan Solution.—We also use the quinin dihydrochlorid and urethan solution recommended by Genevrier. This solution contains 0.4 gram quinin dihydrochlorid and 0.2 gram urethan in each 3 cubic centimeters of water. It gives quite extensive thromboses which are, however, often accompanied by a moderately severe perivenous reaction. In several cases the injection of 2 cubic centimeters of this solution into a varicosity near the ankle has given thromboses extending as far as the upper thigh. With this solution there is more danger of skin sloughs or even ulceration following the injection of very superficial varicosities or following even slight perivenous leakage. We confine its use almost entirely to cases that have not responded well to sodium salicylate or to the treatment of very large

* From the Department of Surgery, University of California Medical School.

* Presented at the Nevada State Medical Association Meeting, September 21, 1928.

individual varicosities. The injection of this solution is usually entirely painless.

TECHNIQUE OF INJECTION PROCEDURES

The technique of injection is quite simple. The choice of a dependent or recumbent position of the leg depends on the size of the varicosities. Small varicosities are injected with greater ease with the leg dependent. Larger ones are preferably injected with the leg either recumbent or semirecumbent, since this permits having the vein less distended and also tends to obviate the leakage about the needle which may occur with a greatly distended vein. We prefer a 10 cubic centimeter all glass Luer pattern syringe and a 26 gauge three-fourths to one-inch needle. The 10 cubic centimeter syringe allows loading with 5 cubic centimeters of the solution and yet leaves ample space for drawing back blood in order to prove that the needle is within the lumen of the vein. A tourniquet or digital pressure may be used 10 or 15 centimeters above the site of injection if desired. This pressure is released immediately after completing the injection. The only important part of the technique is to have the needle within the lumen of the vein and to keep it there during the injection. If perivenous leakage is avoided, the results are almost identical regardless of the position of the leg or the method used. After injection a gauze pad is placed over the vein and the injected area supported by an elastic bandage. This is to keep the injected vein collapsed and is left in place about forty-eight hours. We believe this gives a smaller thrombus that will take less time to organize and shrink. Usually the injected vein is felt as a hard, slightly tender cord thirty-six to forty-eight hours after the injection. This cord rapidly becomes nontender and shrinks in size. From two to twelve weeks are required for complete disappearance.

SAFETY OF INJECTION PROCEDURES

The safety of the chemical method of treatment of varicose veins is of great importance. Although theoretically there is some danger of embolism following injection, the practical experience of thousands of injections reported both in this country and in Europe has shown that the method is a safe one. In this connection the microscopic changes occurring in the vein after injection are of considerable importance. We were fortunate in securing, through the coöperation of two of our patients, segments of veins removed at intervals of five minutes to fifty-six days after injection. All had been injected with 20 per cent sodium salicylate solution. Immediately after injection no change is visible. The endothelial cells lining the intima, however, soon swell and become detached from the vein wall. This begins between one and three hours after injection and is complete in twelve to twenty-four hours. This desquamation is promptly followed by the formation of a thrombus. Platelets are deposited on the damaged vein wall and other platelets and leukocytes adhere to them. Fibrin is liberated and forms filaments extending into the lumen of the vein. Red blood cells become entangled in the meshes of this fibrin.

New layers of platelets and leukocytes alternate with masses of fibrin and entangled red blood cells until the lumen of the vein is completely filled. These red blood cells soon degenerate into a hyaline-like mass. The thrombosis is complete within twenty-four to thirty-six hours after injection. Invasion of the outer layers of the thrombus by fibroblasts and capillaries begins extremely early and often may be seen beginning adjacent to the vein wall even before thrombosis is complete. Within twenty-four to forty-eight hours after the thrombosis, organization is well advanced. This early organization is quite important because of the solid anchoring of the thrombus. The widespread destruction of the intima results in a thrombus adherent to the vein wall at practically all points, thus affording one of the greatest safeguards against embolism. The capillaries in the organizing thrombus tend to coalesce, giving endothelial-lined blood-containing clefts and resulting, in some instances, in a partial recanalization of the vein. After the first week organization of the thrombus is practically complete and the further course is one of gradual shrinkage. The recanalization may increase and give sufficiently large channels to sometimes require reinjection.

The process of thrombosis following chemical irritation of this type differs from the ordinary type of thrombosis following intimal damage, by the extremely rapid organization and by the attachment of the thrombus to the vein wall at practically all points. These are the two important factors in making the injection method of treating varicose veins a safe procedure.

Since July 1927 we have used the injection treatment of varicose veins as the routine procedure at the surgical clinic of the University of California Medical School. During this period we have treated over one hundred and fifty patients. Our end-results have been uniformly satisfactory. Subjectively most of the patients noted a relief from their symptoms following the first few injections that seemed to us out of proportion to the objective improvement. Where ulcers were present at the beginning of the treatment, healing was quite rapid and the patients were quickly relieved of the associated pain and tenderness.

Recurrences have occurred in approximately 6 per cent of our cases. A few of these represented newly developed varicosities, but the majority were the result of recanalization of previously obliterated veins. Reinjection of these cases resulted again in apparently complete obliteration of the varicosities.

SUMMARY

1. The obliteration of varicose veins by the injection of chemical irritants is a safe and satisfactory procedure.
2. The process of obliteration is a chemically induced aseptic thrombosis following the complete destruction of the intima of the vein.
3. The safety of the method depends in part on the firm anchoring of the thrombus to the vein wall at the site of the widespread intimal destruc-

tion and in part on the early and rapid organization of the thrombus.

4. The solution we use as a routine is 20 per cent sodium salicylate. We reserve the quinin solution of Genevriar for cases in which the sodium salicylate fails to give satisfactory results or for the treatment of very large individual varicosities.

5. The method and the technique of the injection are unimportant if the injection is intravenous and no leakage occurs.

University of California Hospital.

DISCUSSION

THOMAS O. BURGER, M. D. (1301 Medico-Dental Building, San Diego).—The popularizing of this method of treating varicose veins is one of our greatest advances in surgery in recent times, and will doubtless do more toward relieving this class of sufferers than any procedure that has been done for many years. There is less discomfort in this method, no loss of time, the avoidance of hospitalization, the avoidance of an anesthetic and of unsightly scars and saving of a great deal in dollars and cents to the individual. All of these factors make it possible for many more people to receive relief who otherwise would go along with their unsightly limbs and the danger of varicose ulcers, and the occasional embolism which does occur in varicose veins in the ambulatory patient. Embolism in individuals who have nothing done is far more frequent than in patients who are operated or treated by this sclerosing method. Embolus is of an infectious nature, and sclerosing is an entirely different condition.

Emphasis should always be placed upon the tests being done which have been outlined in this paper. Be sure absolutely that the veins to be treated, whether by surgery or by the sclerosing solution, are suitable, because treatment should never be given unless deep veins are patent. Deep veins that are not patent only court disaster.

Since this method has become quite common we must warn against gratifying the ladies who have varicose veins, superficial and unsightly, that are so small in lumen they are practically impossible to inject.

Sodium chlorid, 20 per cent, has been the solution we have used in far the greatest number of cases. Except for the thirst very little objection to its use has been found, and it is apparently as effective as any other solution in the ordinary sized veins. However, we do use sodium salicylate, solutions 20 to 30 per cent, and even 40 per cent, in very large veins, where there is a good deal of dilution in the big pools of blood. In one or two instances we have used tourniquets immediately above and below, and have aspirated as much blood as we could get out of the veins before injecting the 40 per cent solution of sodium salicylate, with perfect success.

The armamentarium is quite important even in this minor operative procedure. It is absolutely essential to have a new, sharp, and very small needle, and to have a syringe whose plunger works easily. Real success and real safety follow if you draw blood before injecting, draw blood during the time of injecting, draw blood frequently, and absolutely never inject unless you can draw blood. That done, you will usually save yourself the disgrace of an unsatisfactory come-back, of sloughing and future scarring, which is as bad or worse than the original veins. However, where a large number of cases are treated, one will sometimes have needle leaks or some other mishap which may cause some sloughing.

Do not try to inject too many veins at one sitting, thereby using too much of any one solution. It is not necessary because these patients are not greatly inconvenienced, and if there are many veins to be taken care of, it is far better to have the patient come back

oftener than to try to overdo the procedure at one sitting.

Occasionally we have patients who cry out with pain for a minute or more; others apparently never have any discomfort other than the little needle prick and a slight cramping sensation.

We use tourniquets above the operative area, and one is usually placed around the ankle. In most instances it is left on until an elastic Ace bandage is applied following the very firm pressure made for a few minutes after each injection. This Ace bandage is left on usually for the first forty-eight hours, after which no other treatment is necessary.

As compared with our original method of treating varicose veins by surgery, this safe procedure certainly gives far more benefit at much less cost, a saving of time, money, suffering, and anxiety. It is undoubtedly one of our greatest advances in surgery in recent years.

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HORACE F. PIERCE, M. D. (1421 Chapala Street, Santa Barbara).—Great interest has been aroused by the injection treatment of varicose veins, due, no doubt, to the not too satisfactory surgical treatment of varicose veins. The medical profession as a whole are greatly interested in this method of their cure, which is evidenced by the numerous papers and discussions from without the entire medical world.

Doctors Woolsey and Millzner have brought forward the pertinent points in the pathology of the venous obliteration, which are the destruction of the intima, the thrombus formation, the nailing of the thrombus to the vein wall, so to speak, by the ingrowth of capillaries and fibroblasts, so that the thrombus cannot get away and cause embolism. Recanalization does occur at times and it is due to incomplete destruction of the intima. The vein needs only to be reinjected at a future date to insure its complete obliteration and cure.

We must not forget the difference in the pathology of a chemical venitis, as utilized in the cure of varicose veins, from phlebitis which is a bacterial irritation of the vein wall. In phlebitis a bacterial irritation is present in the vein wall, spotted damage of the intima occurs, thrombus formation is poor, the clot is loose and floats in the venous blood; it may contain bacteria and pus and is a good virile source for emboli. Venitis as produced chemically is not a bacterial hazardous process; it is a definite chemical destruction of the intima with definite fixation of a hard thrombus, hence its safety.

Although we have tried many solutions we have come to prefer sodium salicylate in 20 to 40 per cent strength. Before injecting, and after the needle is in the vein, we like to milk out the blood in the vein to assure maximum destruction of the intima.

Those cases with chronic ulcers, infected skin, eczema, are first treated with Unna's gelatin dressing for support and reduction of the swelling, if the large tributary veins are not visible. We have found one or two injections can be made before the Unna's paste dressing is applied, and as the swelling leaves, the rest of the venous trunk will be visible and can be injected. A combination of high ligation and injection can be done if this is thought necessary; however, so far in our experience, we have not found it necessary to do the combined method of treatment.

The contraindications to the use of this method are few, provided the involved limb responds to the tests for patency of the deep channels. It has been said that pregnancy is a contraindication to the chemical obliteration of varicose veins. However, injections in pregnancy have been used for those cases that need it, and there seems to be no added risk because of the existing pregnancy.

The technique as described by the author needs no further elaboration. We like to begin our injections at the lowest point, namely, about four inches from the ankle and carry the procedure toward the groin. In legs with much swelling, sometimes only the larger pools can be found; after destroying these larger pools

and using supporting treatment, the swelling will gradually leave and subsequently the remaining varices can be injected.

In conclusion, I would add that no procedure has given us or our varicose patients such satisfaction with such a small amount of effort as is involved in the injection and cure of varicose veins.

EXTERNAL BONE PLATING FOR LONG BONES*

By CHARLES ALFRED DUKES, M. D.
Oakland

DISCUSSION by W. C. Adams, M. D., Oakland; Philip Stephens, M. D., Los Angeles; Lionel D. Prince, M. D., San Francisco.

IN preparing a paper upon external bone plates or external fixation apparatus for fracture of the long bones, it is not my purpose to enter into theory of this practice, but to give some of the interesting points that have been developed in my use of this method of splinting of the fractures of long bones. Lambotte, twenty years ago, wrote an article illustrating his method of external bone plates (Fig. 1). Since that time there have been few articles until the appearance of the recent one by Mercier of Montreal.

DUKES' METHOD

Some ten years ago, in a compound fracture where it seemed impossible to get the proper fixation of the fractured bones, I devised from an old Lane plate and a couple of nuts on some stove bolts, a fixation plate with only the ends of the bolts that were screwed into the bones remaining buried. This device was not satisfactory, but it did hold the bones in position until such time as external fixation retained them in firm position.

From that time I began to improve the type of bolt and plate until I developed the external bone plate which is here discussed. I am sure that the simplicity of this method will recommend it. Most of the plates that have been used heretofore have been complicated and inefficient.

Our first difficulty was encountered in screwing the bolts into the bone. First boring the holes was tried; then threading them and screwing the bolts in with the screwdriver. Then a drill slightly larger than the bolt was used so that the bolts were screwed in easily, but this did not answer satisfactorily because the bolts were liable to slip out. Later I devised a bolt with a pointed tip and a square head and screwed the bolts in with a

* Read before the Industrial Medicine and Surgery Section of the California Medical Association at its Fifty-Seventh Annual Session, April 30 to May 3, 1928.

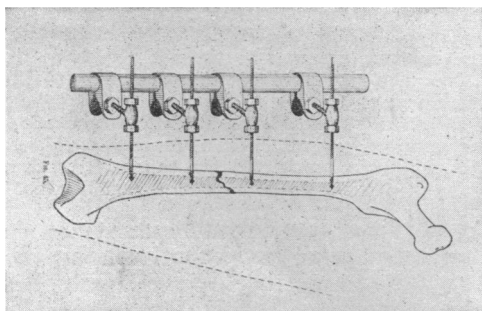


Fig. 1.—Lambotte's earliest plate

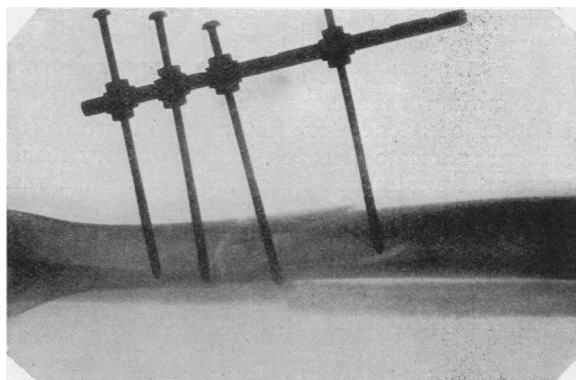


Fig. 2 (a).—Anterior view of Dukes' plate in position on compound fracture of tibia and fibula

wrench. This had its disadvantage because sometimes the bolt head was twisted off. This fault was due to the manufacture of the bolt. The most satisfactory bolt has been an ordinary screw-headed bolt of malleable steel used with an ordinary screwdriver to screw it tightly into place. Some of the failures of this method were due to the improper insertion or depth of the bolt into the bone. In one plate which was placed in the femur, the two upper bolts came out of the bone because of the tension (Figs. 2 and 3). This was due to the bolts not being screwed in deep enough. In another case the tip of the bolt, because of the stress placed thereon, was broken off in the bone; and later it was necessary to remove the tip with a chisel. None of these patients had any serious or lasting effects of ill character from our crude method of application of this device.

In patients where the reduction of the long bone is simply by external manipulation and where it is not desired to make a long incision, a trocar can be introduced under the fluoroscope, the trocar removed and the shield left in place. A drill can be introduced through this and holes made in the bone, and the bolt can be introduced and screwed into place. This makes a procedure as simple as introducing the Steinman pin or a pair of tongs, and with no more attendant dangers.

MERCIER'S METHOD

In the cases where it is necessary to reduce the fracture by the open method, the method used by Mercier of Montreal is excellent.

An incision of the skin and subcutaneous tissue is made down to the bone, the middle of the in-

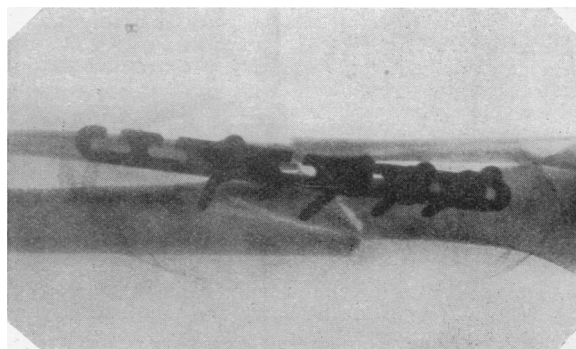


Fig. 2 (b).—Posterior view